Benefit-Cost Analysis (BCA)

Highlights from a Semester Long Class

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Benefit – Cost Analysis

- To inform a choice (or justify it to others)
  - Should Polk County build one large new high school or two smaller ones?
- Pro-Con lists are informal BCAs
- A more formal BCA quantifies

$$Net\ Benefit = Benefits - Costs \text{ or } NB = B - C$$

- Why not Benefit:Cost ratios?
  - Consider the alternatives in the table.
    - Only one can be chosen
    - Each can be done only once
  - Which makes most sense?

Alternative	Benefits	Costs	B-C	B:C
A	$1,050	$1,000	$50	1.05
B	$2	$1	$1	2.00

- Also known as Cost – Benefit Analysis
  - Does not make the basic point, estimating B-C, quite as obvious

Demand for BCA

- Demand for BCA comes from government, advocacy groups, business
  - Sometimes they want to inform a choice
  - Sometimes they want to justify a choice to others
- For a private business the problem seems simpler

$$Profit = Revenue - Cost$$

- Why would a business want a study that would include impacts on their town's children or environmental quality?
  - To make themselves look good to the public
  - To lobby government for favorable decisions (zoning, regulations, etc…)

BCA vs Economic Impact Studies

- Economic impact studies (EIS) determine the impact of something on economic activity in an area
  - For example, opening a Federal Prison in Polk County
- There is direct spending—impacting the primary markets where inputs for the prison are purchased
- There is indirect spending—in secondary markets where those who initially made money from the direct spending spend
- Economic Impact Studies are useful in planning
  - How many roads for new people moving in?
  - How many new schools are needed?
  - How many more police are needed?
  - Will there be enough new tax collections to cover it all?

Do Not Confuse BCA with EIS

- ***Impacts ARE NOT Benefits!***
  - Large positive economic impacts do not mean something is good (NB>0)
  - Large negative economic impacts do not mean something is bad (NB<0)
- Much local economic impact is due to ripple effects in secondary markets
- But the money for the direct spending came from other places, where there are negative ripple contractions in secondary markets
- When considering all impacts, not just local ones, the net impact of secondary market effects on ***net benefits*** **MUST BE NEGATIVE**!
  - The demonstration of that is beyond our scope, see the reference at the end of these slides if you want to work through it

Erroneous conflation of BCA and EIS is Common!

- Economic Impact Studies tend to produce BIG numbers
  - Especially if they look at local ripple expansions and ignore ripple contractions elsewhere!
- If one wants to make a project sound good to people who do not know the difference, they can:
  - Commission a local economic impact study
  - Obfuscate the difference between big positive impacts and big net benefits
  - Get positive PR and press coverage
    - Sometimes it is with intent to mislead
    - Sometimes it is without quite knowing the difference
- Not uncommon for consultants to sell out here
  - They tend to obfuscate the language enough to avoid actually saying the positive economic impact is a net benefit!
- Do not let yourself be misled!

Elements of BCA

- Identify all the alternatives and their impacts
  - Keep track of doing nothing, the status quo, as an alternative
    - Even if you know it would never be selected, it the analytical benchmark
- Define standing
- Monetize benefits and costs
- Conduct sensitivity analysis
- Make a recommendation
- Report to the decision maker(s)
- We will cover all of these
  - Not in this order
  - We will stick to highlights and stupid simple examples
  - The devil is in the details—which we will not get into

Standing

- Different decision makers care about different sets of constituents
  - Local government may not care about impacts on out of towners, or out of staters
  - Should we care about impacts on prisoners? Thieves? Murderers?
  - Private businesses may not care about anything but their profit
- Often useful to report impacts on all individuals, or on groups of like individuals, and let the decision maker decide who to count, or whether to count some as less important than others

Identifying and Enumerating Impacts

- This step is much like making a detailed pro and con list
- Talk to experts, read about the project, gather whatever information you can, and think hard about everything the alternatives entail
- For new things, or very unusual alternatives, this is inherently speculative.
- Better to consider all sorts of reasonably possible scenarios explicitly, and treat which will occur as uncertain, than to ignore possible outcomes

Monetizing Impacts

- Common objections are of the form
  - You cannot put a monetary value on a human life
  - You cannot put a monetary value on the environment

But

- Day to day functioning requires us all to do so regularly, at least implicitly
  - Deciding how much to spend on making your house safer, or whether to take a higher paying but more dangerous job, implies you place a (probabilistic) value on your life relative to other goals
  - Deciding how much to spend on protecting the environment versus building schools versus curing cancer implies a value on these things, at least relative to putting groceries on the table
- Monetization requires finding ways to estimate these values

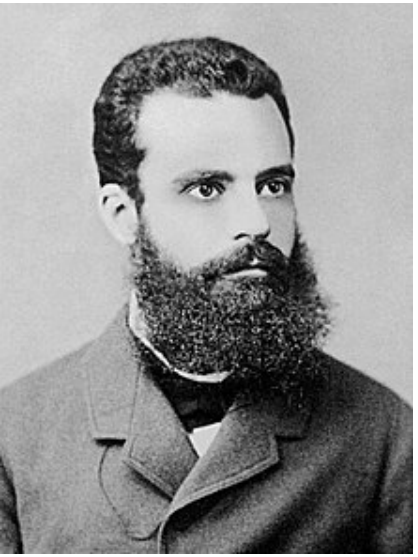
Monetizing Impacts - Conceptual

- Let $\{a_0, a_1,\ldots,a_n\}$ be the set of (n) possible alternatives, with a_0 representing doing nothing (the status quo)
  - Even if doing nothing is almost certainly not going to happen, keeping it as a benchmark helps analytically
- Ask everyone what they would pay to move from the status quo to each of the other options.
  - Assume everyone knows everything about all possible futures and answers honestly. Just go with it for now.
- Those answers are the net benefits, $\{0,NB_1,\ldots,NB_n\}$
- How can we approximate them reasonably with available info?
  - We will return to details about this at the end.
- For now, assume we have NB measures in hand

Making A Recommendation

- It is not up to you to tell decision makers what to choose
- It is not up to you to decide who matters most
- A good report will provide net benefit estimates for different types of impacted parties so the decision maker can make up their own mind as to how to weigh, say, impacts on children and the elderly
- That said, decision makers may want to hear your recommendation
  - Maybe they could use help deciding how to balance things
  - They may value the opinion of an outside party / expert
  - They want someone else to justify a choice for them
- As an (objective) analyst, you can only make recommendations based on well-established criteria, not your own preferences
- Two such criteria are commonly and readily applied
  - Pareto efficiency
  - Kaldor-Hicks efficiency

Pareto Efficiency and a Little Ditty 'bout Jack & Diane



Vilfredo Pareto
1848-1923
Civil Engineer
Economist
Sociologist
Statistician

- Jack & Diane have a coupon for any one item at the Tastee Freez
  - Net benefits in the accompanying table
  - The status quo is a Sundae
  - Which alternatives are at least as good as Sundae for both Jack and Diane?

	Oreo Freezee	Reese's Freezee	Banana Split	Parfait	Sundae
Jack	3	1	2	1	0
Diane	0	7	2	2	0
Total	**3**	**8**	**4**	**3**	**0**

- Oreo Freezee, Reese's Freezee, Banana Split, and Parfait are all Pareto improving relative to Sundae
- Banana Split and Reese's Freezee are Pareto improving relative to Parfait
- Pareto Efficiency rules out Parfait and Sundae
- Pareto Efficiency cannot rank Oreo Freezee, Reese's Freeze, and Banana Split relative to one another!
- Rarely is a single alternative at least as good as everything else for everyone and better for at least someone!

John Mellencamp
1951-
No relevance to BCA whatsoever.

Kaldor-Hicks Efficiency

- Simple: Pick the Reese's Freezee because it has the highest net benefit
- We can think of the option with the highest NB as potentially pareto efficient—it could be so if coupled with sufficient redistribution that winners compensated losers.
  - If Diane paid $2 to Jack, it would be better than Sundae and as good as the Oreo Feezee to Jack, and Diane's NB would still be $5.
  - Since compensation is not actually made, this is little comfort to losers.
- Ultimately, decisions must be made, even though almost any choice creates some losers
- Choosing the highest net benefit alternative leads to a decision and maximizes aggregate net benefits
  - Yes, this is mostly circular, so is not saying much

Long Run Justification of Kaldor-Hicks Efficiency

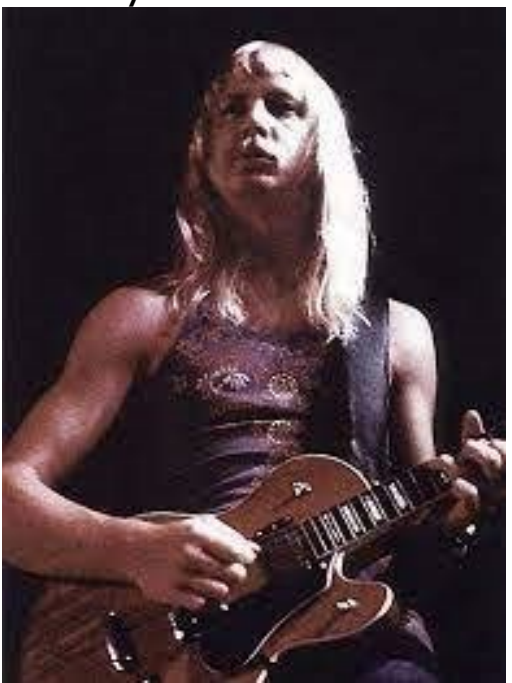
- Suppose decisions arrive independently and randomly, and winners and losers for each alternative are assigned randomly
- Over the long run (lottery after lottery ad infinitum,) since we always pick the highest NB, everyone wins!
- A useful analytical benchmark for thinking about distributional consequences, but hollow in practice because:
  - As Keynes observed, in the long run, we are all dead!
  - Decisions do not arrive independently and randomly
  - Winners and losers are not randomly assigned
  - Winners have the resources to shape agendas and then lobby for favorable decisions, so keep winning due to past wins!
  - US redistribution policy is modestly progressive, but nowhere near enough to ensure winners compensate losers

John Maynard Keynes
(The Right Honourable Lord Keynes)
1883-1946
Civil Servant
Probability Theorist
Political Economist

BCA Produces Structured Educated Guesstimates, NOT Certainties

Masquerading as a man with a reason, my charade is the event of the season, and **if I claim to be a wise man, well, it surely means that I don't know**.

Kerry Livgren. Kansas. 1975. "Wayward Son." *Leftoverture*

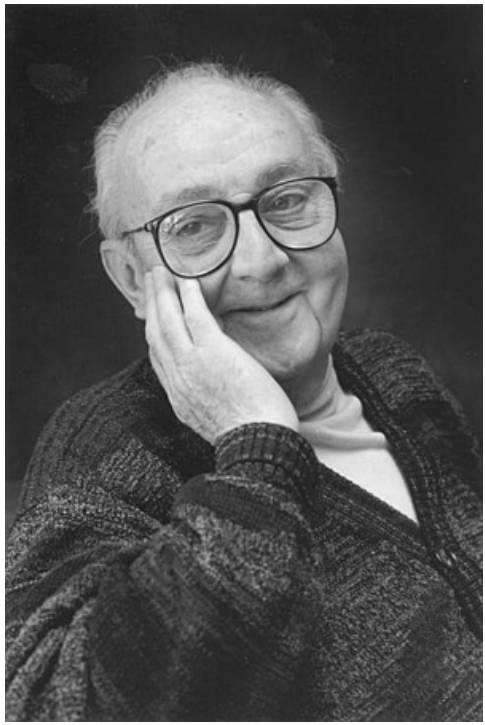


- BCA is full of guestimates
- **DON'T DOWNPLAY OR HIDE THAT!**
- Only a fool thinks they can know such things with certainty
- If you pretend to you will not be taken seriously

And rightly so!

- Trying to precisely quantify the precision of a BCA is a fool's errand!
- What to do? Sensitivity Analysis

All models are wrong, but some are useful.



George E.P. Box
1919-2013
Statistician

Sensitivity Analysis

- A reasonable approach is to formulate three guestimates for BCA parameters
  - Most reasonable case or best estimate (of the reasonably possible values, what is in the middle of the most likely of them)
  - Best case (of the reasonably possible values, what gives the highest NB)
  - Worst case (of the reasonably possible values, which gives the lowest NB)
- The baseline BCA uses the best estimate for all parameters
- The sensitivity analysis recalculates the BCA for many scenarios.
  - Definitely check
    - Each parameter at its best-case value, with others at the best estimate
    - Each parameter at its worst-case value, with others at the best estimate
  - Prepare a summary matrix or figures to communicate these results succinctly
  - Depending on the particulars, you will want to specify other scenarios
    - What if several important parameters all take worst case values
- If it takes extreme outcomes to change the bottom-line recommendation, emphasize that!
- If the bottom-line recommendation is very sensitive to certain combinations of parameters, be clear about that as well.

Modeling Uncertainty in Decision Making

- Not uncertainty in your estimates
  - For which you conduct sensitivity analysis
- Rather uncertain outcomes are inherent in alternatives
  - Sometimes the impact of such uncertainty is small for your purpose, and can be set aside
  - Sometimes it is fundamental to the whole process, and must be modeled
  - It takes knowledge and judgement to decide which is the case for a particular BCA
- Often modeled by formulating discrete but representative contingencies
  - Specify outcomes and associated probabilities
  - Detailed enough to reasonably represent the space of outcomes
  - Few enough to keep the analysis tractable
  - Some cases are easier to model with continuous probability distributions

Modeling Decisions with Contingent Outcomes

- Find alternative with highest expected value
- Assumes “risk neutrality”, only “expected” outcome matters
- Imperfect because most people are risk averse
  - Are you indifferent between these two jobs?
    - A) $100,000 salary for certain
    - B) 0.5 probability of $200,000 and 0.5 probability of $0?
- Simpler than explicitly modeling risk aversion
  - For large organizations (General Motors, state government) that face many such lotteries, risk neutrality is a more reasonable approximation
- Present some info on risk (e.g. standard deviation of net benefits)

Jack and Diane Go into Business

- Jack wants to open two Tastee Freez locations before someone else can
  - To take advantage of the chance growth is fast
- Diane wants to open only one location
  - To expose them to less risk from slow growth
- How to decide? Model it as a Normal Form Game Against Nature—see table.

	Population Growth Contingencies			
	Growth	**Fast**	**Slow**	
	Probability	**0.6**	**0.4**	**Expected Value**
Net Benefits	One Location	20	10	0.6(20)+0.4(10)=16
	Two Locations	30	-10	0.6(30)+0.4(-10)=14

- If these contingencies are a reasonable representation of reality, Diane is right
  - One location has a higher NB
  - Also, if you calculate it, a lower standard deviation
- If the contingencies were a little different (that is, they are not modeled quite right), the decision could be different!

Sensitivity analysis is important!

Information Value

- Jack suggests buying a ***perfect*** forecast of growth
- What is the value of such perfect information?
  - Assuming perfect information just to keep it simple
  - Possible to value imperfect info, but it is more complex, tedious, and time consuming
- The consultant will tell them growth will be fast or slow

  If fast they open 2 and NB=30

  If slow they open 1 and NB=10
- Based on what they already know, they estimate the probability the consultant reports fast is 0.6. So…

  Expected NB with the info is 0.6(30)+0.4(10)=22

  Expected NB without the info is 16 (from before)

  Perfect info is worth $22-$16=$6
- Information can be VERY valuable.
  - Here 3/8ths of the value of the business without the info
- Imperfect info is worth less
  - But still valuable if it has the potential to change the decision

Sequential Decisions and Real Options Under Uncertainty

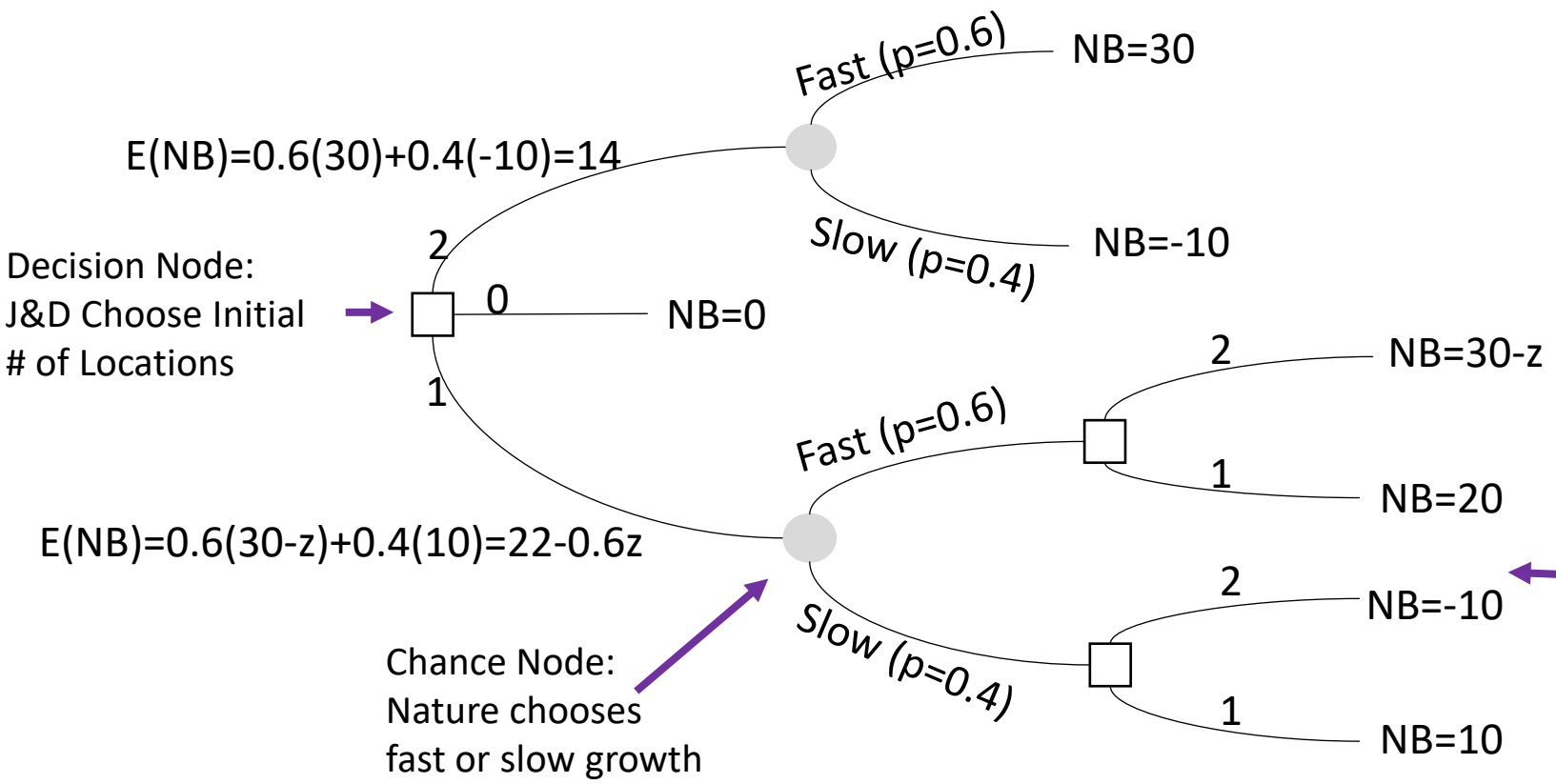
- Getting better information is a way to reduce consequences of uncertainty
- Keeping more (real) options open, and adjusting as you learn, is another
- Being more flexible is not necessarily good. It means potentially missing
  - early profit opportunities
  - Strategic first mover advantages, allowing competitors to establish themselves
- How are such decisions modeled?

Extensive Form Games Against Nature

- Solve by:
  - Starting at the end and pruning branches we would not choose
  - Whatever is left is the best (contingent) choice path

Jack and Diane Have Real Options

- Continuing from the previous example, Jack and Dian can purchase an exclusive option for a second franchise and wait to open it until they see if growth is high
- If they wait to open the second location, and growth is high, they miss out on $z<10 of profit while waiting



The option is worth:

22-0.6z-16 = 6-0.6z

If it costs more, better to just open 1 location and live with it

If it costs less, buy it and only exercise it if growth is fast

Long Lived Projects

- Projects may take a long time to complete and may be in use longer
  - There are Roman roads in use today!
- When benefits and costs occur at different points in time, adjustments are needed to make to express them in comparable terms
- Some important factors are
  - Inflation
  - The Time Value of Money
  - Obsolescence
  - Growth
  - Horizon Values

Inflation

- $1 will likely purchase less in the future than today
  - Deflation can occur as well
- Simplest to keep everything in today's (year 0, launch year) dollars
  - Adjust all historic values to current dollars using an appropriate price index
  - Use today's dollars to price future expenditures
- **Inflation is not the same as real (or relative) price changes!**
- If the price of gas goes up faster than other prices change, it means gas has become scarcer relative to other things
  - Even if budgets keep pace with inflation, buying gas leaves less room for other things
  - If there is reason to expect prices of some important inputs to change at notably different rates than average, include the portion of the change that is REAL in your estimates

Dealing with Inflation – Price Indices

- The Consumer Price Index is the most well known, available from the Bureau of Labor Statistics at www.bls.gov
- Various others, overall (e.g., the GDP deflator) and for specific categories of items are available from the Bureau of Economic Analysis at www.bea.gov
  - Lots of relevant data is maintained in an easy to browse and download form at the Saint Louis Federal Reserve Economic Database, FRED, fred.stlouisfed.org
- Conversions from historic to current prices are illustrated in the table using the GDP deflator.
  - The index base year is 2012
  - To convert $23,453 from 2010 to 2022 dollars:

$$\$23{,}453 \times 127.225/96.164 \approx \$31{,}028$$

Year	GDP Deflator	2022 Conversion Factor
2010	96.164	1.323
2011	98.157	1.296
2012	100.000	1.272
2013	101.769	1.250
2014	103.662	1.227
2015	104.662	1.216
2016	105.703	1.204
2017	107.743	1.181
2018	110.344	1.153
2019	112.303	1.133
2020	113.814	1.118
2021	118.924	1.070
2022	127.225	1.000

The Time Value of Money

- Even after adjusting for inflation, you would not trade $1 today for $1 tomorrow.
- If you put $1 in an account bearing 0.05 (5%) annual interest after inflation (the real interest rate, r), it turns into

  $1.05 worth of stuff in one year

  $\$1 \times 1.05^3 \approx 1.16$ worth of stuff in three years

- Assuming r is constant:
  - After 1 year: $V(1)=(1+r)V(0)$, or, $V_0=V_1/(1+r)^1$
  - After 3 years: $V(3)=(1+r)^3V(0)$, or, $V_0=V_3/(1+r)^3$
  - After t years: $V(t)=(1+r)^tV(0)$, or, $V_0=V_t/(1+r)^t$

Present Value

- The present value (V at t=0) of payments of V_t from t=1 to t=T is:

$$V_0 = \frac{V_1}{(1+r)^1} + \frac{V_2}{(1+r)^2} + \cdots + \frac{V_T}{(1+r)^T}$$

$$V_0 = \sum_{t=1}^{T} \frac{V_t}{(1+r)^t}$$

- Real and Nominal Interest Rates
  - The real interest rate (r_t) is (approximately) the nominal rate (i_t, quoted by lenders, borrowers) less the rate of inflation (m_t), provided rates are not too high

The Choice of a Real Discount Rate

- For a private company's internal use, that is it is a profit potential analysis, use their cost of borrowing
  - Interest on debt less an estimate of the expected rate inflation
- For a government agency or the public
  - The rate governments pay on debt less the expected rate of inflation is reasonable
    - Probably too low, because it does not reflect the circumstances of their tax paying citizens, but it is a reasonable choice
  - An estimate of the "social discount rate" from a credible study is better
    - Complex, but 3.5% is reasonable

Obsolescence, Growth, and Scrap Values

- Obsolescence (hazard rate h_t)
  - Products do not stay in demand forever
  - Infrastructure depreciates
  - Businesses go out of business
  - Take expectations of future costs and benefits with probability, h_t, that V_t drops to 0.
    - $1-h_t$ is the probability the project continues at t with $V_t>0$.
- Growth
  - Take expectations of future values for different reasonable growth rate (g_t) contingencies
- Horizon Values
  - At some point, T, (often around 20 years), represent the value of whatever the future holds from then on with a single value, Horizon Value (H_T)
    - Could be for the scrap value (clean up costs are negative scrap value)
    - Could be liquidation of a business
    - Could be expected value ad infinitum from then forward
  - Estimating horizon values accurately is hard
- All these things are very good candidates for sensitivity analysis

A (Sometimes-Useful) Way to Put Many Pieces Together

- Suppose you can reasonably guestimate NB over T years, but it becomes more like taking a wild guess after that.
- Suppose, as a reasonable approximation, the rate of growth (g), the probability of obsolecense before each period (h), and the real interest rate (r) can all be treated as constant through t=T.
- Let v be the value in year 1. Then:

$$V_0 = v \sum_{t=1}^{T} \left(\frac{(1+g)(1-h)}{1+r} \right)^t + H_T$$

or

$$V_0 = v \sum_{1}^{T} \delta^t + H_T$$

where the discount factor is $\delta = \frac{(1+g)(1-h)}{1+r}$

Annuity Formula

- Consider the sum: $S = \delta^1 + \delta^2 + \cdots + \delta^{T-1} + \delta^T$
- Multiply by δ: $\delta S = \delta^2 + \delta^3 + \cdots + \delta^T + \delta^{T+1}$
- Subtract the second from the first: $S(1-\delta) = \delta^1 - \delta^{T+1}$
- So: $S = \frac{\delta}{1-\delta}(1-\delta^T)$
- Applying this to what we had at the end of the last slide:

$$V_0 = v\left(\frac{\delta}{1-\delta}\right)(1-\delta^T) + H_T$$

where $\delta = \frac{(1+g)(1-h)}{1+r}$

Example

- Suppose: $NB_1 \approx 25$, $r \approx 0.035$, $g \approx 0.015$, $h \approx 0.01$, $T=20$
- Then: $\delta = \frac{(1+0.015)(1-0.01)}{1+0.035} \approx 0.971$
- Applying this:

$$V_0 \approx 25 \frac{0.971}{1-0.971}(1-0.971^{20}) + H_{20} \approx 372 + H_{20}$$

- Still need to estimate horizon value.
  - One way is to assume things continue as before from t=21 onward ad infinitum, discount that back to time t=0, then do robust of sensitivity analysis with respect to this Horizon value do to the extreme uncertainty about the far future!

Monetizing Impacts – Primary Market Valuation

- One way to get benefits and costs is to look at impacts in directly impacted markets
- Assume for now competitive, well functioning, markets that tend strongly toward balance between supply and demand (equilibrium)
- Is the alternative going to have a large enough impact to produce a notable change in price?
- If not, value changes in quantities at the market price
  - If a youth sports program produces tennis lessons, value them at the private market rate
  - If a program has to buy bottled water, value it at the market rate
- What about when price is impacted by the alternative?

Primary Market Valuation When Prices Change

- Must account for the impact of the price and induced quantity changes
- Consumer Surplus
  - Measure of how much better off consumers are because they get to buy a product at the prevailing price (versus the market not existing)
- Producer Surplus
  - Measure of how much better off producers are because they get to sell a product at the prevailing price (versus the market not existing)
  - Includes profit
  - Also includes returns to factors of production (particularly land and labor) above what they could get in their next best alternative (economic rents)
- Requires a way to estimate price changes
  - Find examples like your alternatives
  - Find published BCAs of things like your project
  - Look for estimates of supply and demand elasticities in academic and trade journals
    - Use them to estimate likely price or quantity responses
- Illustrative example to come…

Accounting for Primary Market Externalities

- Consumer and Producer Surplus measure impacts on market participants – internal to transaction
- Some transactions have notable impacts on parties external to the transaction—externalities
  - Education is thought to produce positive externalities, benefiting communities beyond the direct benefits to the ones receiving education
  - Burning gasoline produces negative externalities—pollution, additional congestion and wear and tear on roads
- Associated changes related to externalities should be factored in
  - Often you can find published estimates of marginal external impacts

Public Funds

- Raising $1 in public funds costs taxpayers more than $1
  - Administrative costs
    - May be mostly fixed and grow only slowly with increases in funds raised
  - Taxation drives a wedge between economic benefits and costs, wastefully changing decisions to avoid the tax
    - These efficiency costs, shadow costs, increase approximately with the square of the tax rate!
- Estimates of the shadow cost of public funds vary, but $0.25 per dollar of public funds raised is a reasonable estimate
  - If your project needs public funds
    - The funds themselves are just a transfer from taxpayers to your project, not a net cost
    - There is a net cost from paying this shadow cost
  - If your project generates public funds
    - The funds are a transfer from your project to taxpayers, offsetting other taxes
    - There is a net gain from avoiding this shadow cost on the taxes offset

Illustration—Gas Tax—Background

- The main intent of the gas tax (federal, state, and local) is to fund roads
- It is in large part a user fee for roads
- User fees mimic market prices
  - Econ 101—if the fee corresponds to the incremental system cost, you get efficient utilization
    - Inefficient to use something with value less than cost because the price is too low
    - Inefficient not to use something with value more than cost because the price is too high
- The current tax is short of covering road maintenance and construction
  - Eroded by increasing fleet fuel economy and inflation since it indexed to neither
  - Those that don't use roads much are subsidizing those that do through other taxes (income, sales, property)
  - This is an external cost!
- The current tax insufficient to internalize pollution related externalities

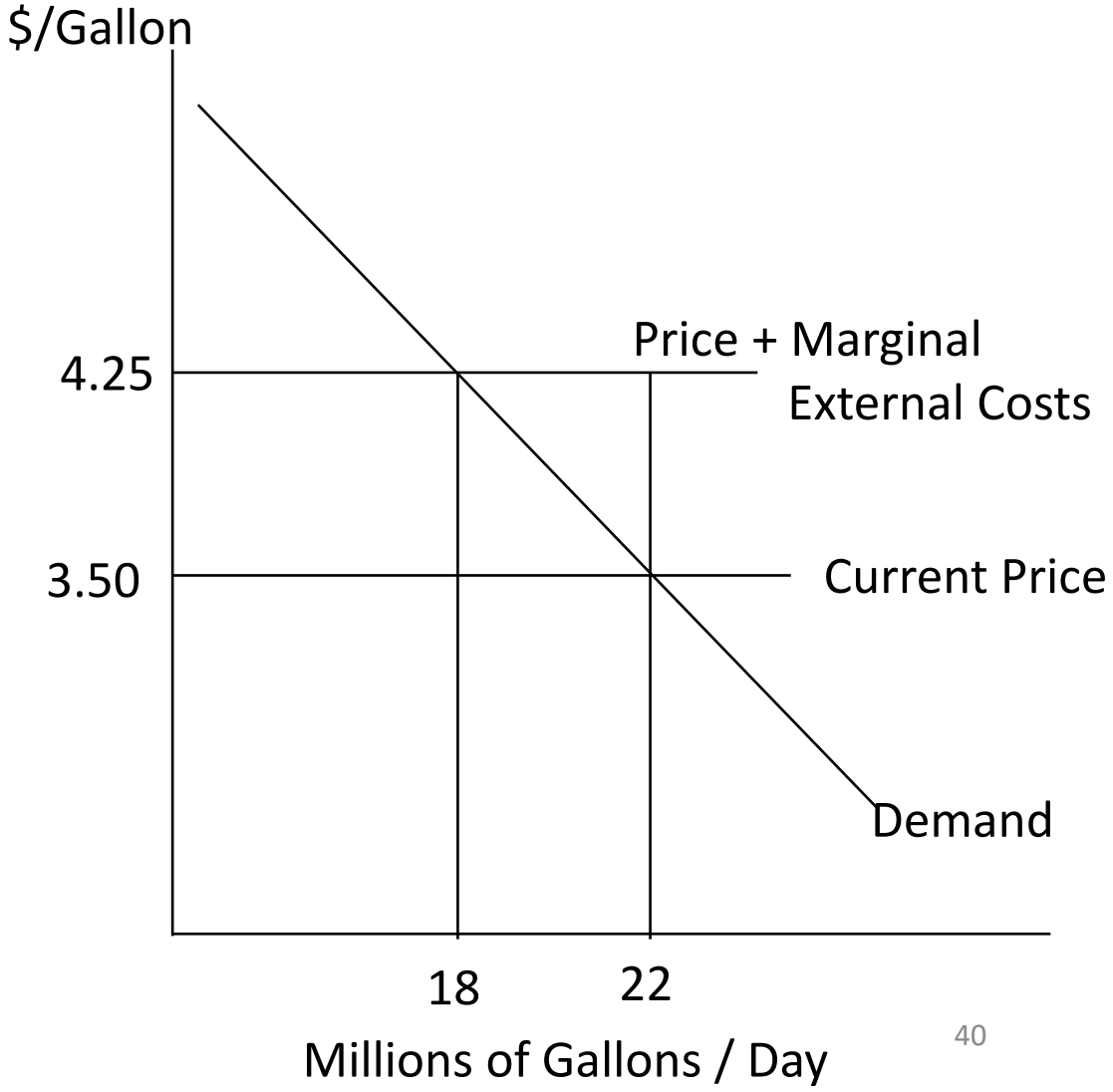
Illustration—Raising Florida's Gas Tax—Assumptions

1. The gas tax is fully passed on to consumers
2. The tax inclusive price is $3.50/gallon
3. The gas tax is $0.50
   Federal, state, and local combined
4. 20 million gallons per day are consumed in Florida
5. The price elasticity of demand for gas is 0.5
6. The shadow cost of public funds is $0.25
7. The tax would need to be $0.25 higher to cover road costs
8. The tax would need to be $0.50 higher to cover pollution costs

- 1-6 are not ***too*** far out of line with reality
  - Rounded to get easy numbers!
- Estimates for 7 & 8 vary widely!
  - I picked easy numbers for illustration.
  - Good chance these are quite a bit low!

Raising Florida's Gas Tax by $0.75/Gallon—BCA

- Price would increase about 20% (425/350≈1.2)
- The elasticity of demand of 0.5 means quantity demanded will fall about 10%, to about 18
- This saves 0.75×2=$1.5 m/day in external costs (a gain)
- The consumer surplus on the 2 m gallons/day no longer purchased is 0.75×2/2=$0.75 m/day (a loss)
  - The triangle below demand and between the prices
  - The midpoint of the value (from the demand curve) for these gallons multiplied by the reduced consumption
- The increased tax transfers 0.75×18=$13.5 m/day from consumers to taxpayers (offsetting loss and gain)
- The saved shadow cost of public funds is 0.25×13.5=$3.375 m/day (a gain)
- Net benefit is 0.75+3.375=$4.125 m/day
- The (too) low gas tax costs (Florida and the world) about $1.5 billion annually by encouraging the use of 730 million gallons of gas with benefits below costs!



Market Valuation Complications

- The approach above breaks down if
  - Markets are too slow correcting toward equilibrium
    - e.g., Unemployment in long term depressed regions
  - Market participants have lots of market power
    - Monopoly or monopsony
  - There are appreciable secondary market price changes
    - e.g., an increase in gas prices, due to a gas tax hike, drives up the prices of transportation services enough to significantly impact their volume
    - Secondary market prices are usually not expected to change much
      - In which case ALL relevant info is captured in the primary market
- Getting into these is beyond our scope
  - That does not mean you can always ignore them!

Other Ways of Monetizing Benefits and Costs

- Contingent Valuation
  - Ask, in a survey, what people would pay for something
  - Why should they think hard enough to give an accurate answer?
  - How would they really know enough to answer if they tried?
  - They might answer strategically, or to make themselves look good
- Hedonic Valuation—Revealed Preference
  - Estimate statistical models relating market prices to desirable product attributes
  - Since it uses actual prices paid, it is a ***revealed*** preference approach
    - Not self reported valuation
  - Hedonic refers to the analysis of utility bearing product characteristics
  - Often used to extract shadow prices
    - e.g., estimating the value of a statistical life year from how wages vary with the danger of a job
- A literature search will uncover studies using these techniques
  - You can likely borrow from closely related studies
  - You might find a very similar BCA

More Information

- The information herein captures only highlights of my BCA class
- It leaves out derivations, details, complexities, context, depth in explanations, and more complex illustrative examples
- Detail may be found in the book for that class, the leading text in the area, written by economists who are academics ***and*** BCA practitioners

Boardman, A., Greenberg, D., Vining, A., & Weimer, D. (2018). *Cost-Benefit Analysis: Concepts and Practice* (5th ed.). Cambridge: Cambridge University Press. doi:10.1017/9781108235594